

Teaching CS50 with AI: Leveraging Generative Artificial Intelligence in Computer Science Education

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Abstract

In Summer 2023, we developed and integrated a suite of AI-based software tools into CS50 at Harvard University. These tools were initially available to approximately 70 summer students, then to thousands of students online, and finally to several hundred on campus during Fall 2023. Per the course's own policy, we encouraged students to use these course-specific tools and limited the use of commercial AI software such as ChatGPT, GitHub Copilot, and the new Bing. Our goal was to approximate a 1:1 teacher-to-student ratio through software, thereby equipping students with a pedagogically-minded subject-matter expert by their side at all times, designed to guide students toward solutions rather than offer them outright. The tools were received positively by students, who noted that they felt like they had "a personal tutor." Our findings suggest that integrating AI thoughtfully into educational settings enhances the learning experience by providing continuous, customized support and enabling human educators to address more complex pedagogical issues. In this paper, we detail how AI tools have augmented teaching and learning in CS50, specifically in explaining code snippets, improving code style, and accurately responding to curricular and administrative queries on the course's discussion forum. Additionally, we present our methodological approach, implementation details, and guidance for those considering using these tools or AI generally in education.